DOCUMENT RESUME

ED 258 539 IR 011 690

AUTHOR Christoffel, Pamela
TITLE Higher Education and New Information Technologies: Trends and Issues.
INSTITUTION Organisation for Economic Cooperation and Development, Paris (France). Centre for Educational Research and Innovation.
REPORT NO CERI/NT/84.03
PUB DATE Jul 84
NOTE 40p.; Contained in papers of the International Conference on Education and New Information Technologies (Paris, France, July 9-12, 1984), see IR 011 688.
PUB TYPE Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Computer Assisted Instruction; *Computer Software; Counseling; Economic Factors; *Educational Policy; Educational Research; *Educational Trends; Futures (of Society); Government Role; Higher Education; *Information Science; *Policy Formation; School Business Relationship; Surveys; Teacher Role; Videotex
IDENTIFIERS *Computer Uses in Education

ABSTRACT

Prepared for a 1984 Organisation for Economic Cooperation and Development (OECD) conference, this report is primarily based on responses by ten member countries to a survey concerning the introduction of new information technologies--computer assisted and managed instruction, computer science training, software, and educational uses of telecommunications--into higher education. The first section outlines current developments at the national level in terms of planning, policy formation, public policy developments in specific member countries, and the influence of industry. Also discussed are developments at the institutional level that relate to expanding the education mission through new information technology use in professional, distance, and general education; developing new educational functions; searching for courseware; use of computer assisted counseling, computer assisted instruction, computer managed instruction, networking systems, and videotex systems; access to broad information and databases; the impact of research; the role of faculty; and the influence of industry. Issues that will confront policymakers and educators in the future are also addressed, as well as public policy issues that must be resolved in member countries and major questions still facing colleges and universities. Countries participating in the survey are listed as Belgium, Finland, France, Ireland, Japan, Scotland, Sweden, Turkey, and the United Kingdom. (MBR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED2585539

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

RESTRICTED

Paris, drafted: 15th May 1984

Centre for Educational Research
and Innovation

dist: 21st May 1984

CERI/NT/84.03

Or. Eng.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

International Conference on Education and New Information Technologies

Château de la Muette
9th-12th July 1984

HIGHER EDUCATION AND NEW INFORMATION TECHNOLOGIES: TRENDS AND ISSUES

1. The attached document has been prepared by Pamela Christoffel, United States, in her capacity as consultant to the Secretariat. It will serve as a background report for the Plenary session on Theme 1 and Working Group 1 and 3.

2. The views expressed are those of the author and do not commit either the Organisation or the national authorities concerned.

BEST COPY AVAILABLE

IR011690

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

OECD

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TABLE OF CONTENTS

	Paragraphs
INTRODUCTION	1-14
A. Study Background	1-5
B. The Broader Context	14
Section I: TRENDS OBSERVED	15-100
A. Public Policy Developments	20-34
B. Trends in Higher Education Institutions	35-93
1. Expanding Education Mission	36-50
2. Developing New Educational Functions	51-59
3. Searching for "Courseware" and Other NIT Uses	60-80
4. Strengthening Research	81-86
5. Identifying the Faculty Role	87-93
C. The Influence of Industry	94-100
Section II: ISSUES FOR THE FUTURE	102-154
A. Public Policy Issues	103-124
B. Institutional Issues	125-147
1. Expanding Mission	126-131
2. Searching for Content	132-141
3. Strengthening Research	142-145
4. Identifying the Faculty Role	146-1457
C. The Issue of Industrial Cooperation	148-152
D. Prospects for the Future	152-154
NOTES AND REFERENCES	

...

INTRODUCTION

A. Study Background

1. As part of the preparations for the Conference, the OECD Secretariat distributed a questionnaire to member countries. The survey (CERI/NT/82.01), mailed in May 1982, sought information concerning the introduction of new information technologies (NIT) in each OECD Member country. The country enquiry did not define NIT, but implied a broad definition by including questions about computer-assisted and computer-managed instruction, computer science training, software, and educational uses of telecommunications. The survey focused on the primary and secondary education levels, with the higher education and adult learning portions being optional for respondents. Nevertheless, some countries (1) provided at least a brief response to the higher education section of the survey. These higher education responses from Member countries serve as a starting point for this issue paper.

2. In addition, a number of available secondary sources describing recent higher education and NIT developments in the various countries have been used in preparing this report. Unfortunately, the total amount of available data and information in the higher education sector is not great. This paper, therefore, is not a comprehensive survey of the field, but instead should be considered a brief overview of trends and issues. Its purpose is to begin a dialogue among Member countries on the subject of higher education and the NIT.

3. This report is divided into two main parts. The first (TRENDS OBSERVED) outlines some of the current developments - at the national level in terms of planning and other initiatives, and at the institutional level in terms of utilization of the NIT. Within institutions of higher education, this study examines possible changes in educational mission, functions, educational "courseware", research and the role of faculty.

4. The second part of this report (ISSUES FOR THE FUTURE) addresses some of the questions which will confront policymakers and educators in the decade ahead concerning the NIT and higher education.

5. Before moving to the first major section of this report,

however, it is worthwhile to consider briefly the context in which systems of higher education operate in OECD Member countries today.

B. The Broader Context

6. Over the past decade OECD Member countries have faced a period of economic troubles which have caused high unemployment, financial pressures and significant restrictions in governmental budgets. Older industrial bases have eroded. Foreign competition is strong in a world where international commerce is commonplace. Attempts to foster international economic cooperation to help offset these ills have met with only limited success.

7. At the same time, Member countries are passing through an extraordinary period of rapid technological development and change. Countries are anxious to modernize their economies, increase employment by creating new jobs, train new professionals and technicians and revitalize their financial situation in the face of what the French Prime Minister has called the "third industrial revolution." Computers and other elements of the NIT such as advanced communication systems (cable, microwave, interactive videotex, etc.) are an important part of this new revolution.

8. The situation facing higher education institutions in OECD Member countries is also troubled. In part this state of affairs is due to the broader economic context, and in part it is due to other, separate factors. Described simply, the factors affecting postsecondary education in the developed countries include:

i) actual or expected declining enrollments which are spurring efforts to attract 'new' students such as adults;
ii) increasing operational costs coming at a time of decreasing public support;
iii) new demands from students for more specific vocational programs, such as engineering, computer science, and other professional studies;
iv) rising pressure from governments at various levels to educate for specific (growing) employment sectors; and
v) greater expectations that the higher education system's capability to support economic and technological progress must be improved.

9. Higher education institutions are often regarded as "public utilities" in many Western European countries. Governmental interest and scrutiny is keen, there and in other OECD Member countries, as universities are reviewed as to their capabilities to help countries out of tough economic conditions. At the same time, enrollment situations are changing, the difference being described as higher education institutions moving from a condition of "apoplexy" to one of "anemia."(2) Educational costs for facilities and maintenance, for

faculty, and for new educational equipment are rising. Yet a recent headline in the International Times Herald reads "West Europe Making New Cuts in Social Programs"(3) with education funding included in these reductions. The situation is similar in the United States, the United Kingdom, and elsewhere.

10. In addition to these problems, students and others continue to criticize higher educational institutions for being out of touch with the world of work, offering programs and courses not well related to necessary job skills and positions. Recent high unemployment levels have sharpened student concerns here. Increasing numbers of students are 'voting with their feet' at colleges and universities, swelling enrollments in such practical educational programs as engineering and computer science, where jobs upon graduation appear more likely and disregarding such programs as humanities and arts.

11. Yet business and industry in many OECD countries remain dissatisfied with higher education's 'outputs.' In Italy, for example, engineering companies have become so disenchanted with the quality of engineering students coming from engineering schools that they have set up their own evaluation system.(4) In the United States several large corporations have set up their own colleges, accredited to give degrees, in order to train employees better. In many Member countries colleges and universities can not prepare graduates in certain fields fast enough to meet the immediate needs of industry.

12. The impact of these complicated and harsh realities for higher education - particularly relating to such problems as access, changing relationships between higher education, communities and working life, patterns of authority and financing issues - are discussed in depth in the recent OECD publications, Policies for Higher Education in the 1980's and The University and the Community: The Problems of Changing Relationships(5). The problems need not be repeated here. Suffice it to say that the presently troubled context for higher education in most developed countries should be considered as essential background to the topic of this paper: the impact on higher education of NIT. External and internal pressures on the higher education 'enterprise' are an integral part of the problems and potential outlined in this brief analysis.

13. Both policy-makers and college and university officials are asking questions like the following. As we move into the "Information Age," will higher education be able to contribute to the pace of technological and scientific advancement in OECD Member countries? Will the education about and use of NIT in higher education help students in their preparation for work? Will colleges and universities be able to prepare and train the new cadre of professionals and others needed to staff the "third industrial revolution"? Can the use of NIT help institutions attract new students to offset declining enrollments? Will their use enable schools to teach and educate more effectively? What are the costs and benefits?

14. Even the most fervent enthusiast for the potential of the NIT will agree they represent no panacea for higher education - no easy answers to the external and internal pressures facing colleges and universities today. But can they help? What are the current trends toward implementation of the NIT in higher education? What issues remain unsolved? A broad study of the inter-relationships among governments, industry and higher education in the area of NIT development is clearly beyond the scope of this effort. Instead, this brief analysis seeks to describe current trends in the various countries and goes on to point out some of the major issues regarding the use of NIT which will continue to confront us in the next decade.

Section I

TRENDS OBSERVED

15. Detailed information and accurate data about the use and impact of NIT is in short supply. But from country responses to the OECD survey in this field and a variety of secondary sources, the following picture can be drawn.

16. In terms of governmental planning, a significant number of countries have begun developing public policies, with some also providing support for programs or equipment.

17. Within colleges and universities themselves can be seen trends toward an expanding educational mission - for professional education, for more general education and for educational outreach via distance learning. New educational functions are emerging, using computer-assisted instruction (CAI) and computer-managed instruction (CMI). The search is on for new educational materials to be delivered using information technologies - the problem of finding or developing quality software. Research missions are being redefined in many higher education institutions as the NIT are made more available on campus. And the heart of colleges and universities, the faculty, are struggling to identify their role in the utilization of these new learning tools.

18. And what has been the influence of industry in all of this activity?

19. All the above factors are having at least some significant impact on higher education, varying of course in each individual country. These policy developments and trends within higher education institutions themselves are described in some detail in the next sections.

A. Public Policy Developments

20. Across OECD Member countries, the general economic problems and increased pressures on the higher education system have led to a great diversity of response. This situation is also true with respect to the particular issue of NIT. In fact, it has been noted that "national policies, to the extent that they exist, are essentially concerned with lower levels of education, and exceptionally only with the university (or other higher education institutions)."(6) However, some countries (France, England, Scotland, the Netherlands) have done a significant amount of planning for the integration of NIT into their higher education systems. The impetus here has largely come from economic and new manpower development pressures, though there is also a desire, especially in France, to improve the education system as well.

21. Existing national policies do not generally assign special responsibilities to institutions of higher education in the policy implementation process, or in the development of informatics throughout the educational system. France is a major exception here. In France, the Ministry of Education's "plan de developpement informatique" was developed out of a major study begun in July, 1981. This "Mission of enquiry on informatics in the school" resulted in a report to the Minister of Education titled "L'introduction de l'informatique dans l'Education Nationale," also known as the Pair/LeCorre report.(7) The new policy had three main objectives: first, to give information technology a place in general education; second, to use information technology to make teaching more effective; and third, to educate future specialists in informatics and professionals who will be needed.(8) Higher education is expected to play an "essential role" in the development of these new French policies.

22. In contrast, there has been little national planning regarding higher education and NIT in such countries as Germany, the United States and Canada. Clearly this is due in large part due to the federal structure of these countries and the traditionally small role played by their national governments in the development and functioning of their higher education systems. In the United States, for example, the federal government has done virtually no planning for implementation of the NIT into the higher education sector.(9) Some planning activities have been undertaken at the State level, through the State Higher Education Executive Offices in particular states. But in most cases planning has been left to individual colleges and universities, with major initiatives also coming from business and industry.

23. National planning activities in other OECD Member countries, notably Japan, Ireland, Finland, Belgium and others fall somewhere in between in range of effort. The impetus in these countries is usually

a mixture of forces - economic, manpower needs, desires for regional development and, to a limited extent, plans to improve the educational system as a whole. Most have developed at least some plans or established national committees and advisory groups to consider the problem and make recommendations to their governments for future development.(10)

24. In Japan, for example, an advisory committee to the Ministry of Education, Science and Culture (Monbu-Sho) has recently been asked to study and report on the following questions:

i) How can the new technologies, especially information and communication technologies, be utilized?
ii) How can educational information network systems be developed? and
iii) How should the problem of media literacy (including computer literacy) be dealt with?

25. The committee is scheduled to submit a report on computers by June 1984.

26. Several study and working groups have been appointed by the Finnish Ministry of Education. One has been examining the potential of computer-assisted instruction in higher education. Another considered the use of computers in university-level education. The Ministry also prepared a plan recently concerning the development of automated data processing (ADP) training in higher education.

27. In Ireland, the Higher Education Authority's Advisory Group on Computer Services has recommended the formulation of a five year plan for computer development and the establishment of integrated systems and networking between colleges.

28. These are just a few examples of the various kinds of national planning activities undertaken within the last few years in OECD Member countries. The overall situation is in a state of flux, with national policies constantly being developed and adapted.

29. In some cases the planning efforts have been followed by actual funding for equipment or programs. As would be expected, this has generally occurred in member countries with strong policy development efforts. In the United Kingdom with its generally decentralized higher education system, the autonomous universities are funded through central government which channels monies to the University Grants Commission (UGC) for distribution to individual universities. Planning groups in the area of educational technology have been active for years here. At the end of 1982 the British government announced a 100 million pound three year programme for boosting information technology. The effort called for an additional 2,000 students in 1983 in universities, polytechnics and other colleges, building up to over 5,000 in 1985-86. It also included a significant increase in provision in non-advanced further education, and a large new programme of

research grants and fellowships. Sixteen polytechnics and colleges were chosen for a two million pound funding program for information technology courses.(11)

30. In France, 139.7 million francs were budgeted in 1983 at the university level, up 59% from the previous year's spending, and efforts are currently underway to increase the numbers of students earning diplomas in informatics. Fifteen university centers are also being established to train teachers, and other higher education projects are being implemented as well.

31. It should not be assumed that in these various countries, national-level planning is carried out neatly and logically prior to actual provision of monies. In reality, planning is often carried out at the same time individual (sometimes uncoordinated) projects are being funded. Few governments are so organized that they are able to carry out detailed and comprehensive planning for implementation of NIT before acquiesing to demands for funding of particular projects or equipment purchases at individual institutions. The result is somewhat haphazard and uncoordinated development, with planning activities in some cases trying to rationalize and account for already ongoing activities or programs.

32. Still, renewed efforts to conduct national NIT planning has been carried out in many OECD countries, particularly in Europe, as governments move as quickly as possible to catch up with events. They are being pressured into action by concern that rapidly developing technology, bringing new business and new jobs, may pass them by and be attracted to other, more competitive nations which have been willing to plan for and invest in the NIT. Indeed the broader problem of economic development in this period of high technology growth is the real spur to government action here. Even countries with no significant national planning efforts underway have made a choice. As at least one expert has pointed out, "Deliberate absence of policy is itself a policy."(12)

33. The current United States view is that, given the right economic conditions, private enterprise, including the higher education system, will work perfectly well if left free of national government intervention in the development of NIT. Other countries have opted for a more mixed approach, with some planning and varying amounts of government funding and incentives. Their major focus may be on secondary education, but higher education planning is becoming increasingly evident.

34. National planning efforts will be discussed further in the next sections as an examination is made of trends in higher education institutions themselves.

BEST COPY AVAILABLE

B. Trends in Higher Education Institutions

35. In an era of retrenchment for higher education, the introduction of NIT in colleges and universities must be considered a bright spot, generating not a little excitement and optimism. New equipment, new courses, new students, new interest - all combine to quicken the tempo of activity at many higher education institutions. Whether the impetus has come from government or from within the institution itself, the impact of the introduction of the NIT has been felt in a number of areas. (It should be noted here that trends in teacher training, a task of higher education institutions, are not addressed in this paper. Instead, they are covered in the OECD paper, "The Introduction of New Information Technologies in Education: Policy Trends and Developments in Member Countries" (CERI/NT/84/02).

1. Expanding Education Mission

36. In professional education, in general education through the liberal arts, and in distance learning, institutions of higher education have begun to expand their education mission. This process is occurring across most OECD Member countries - sometimes slowly in only a few colleges or universities, but elsewhere in a large number of institutions.

37. In professional education there has been substantial growth, not only in the particular field of computer science but in other professional fields as well. This growth is evident in most Member countries, and it is clear that it is in this area of professional education that the NIT have had their greatest impact on institutions of higher education. In Japan for example, the number of computer science departments grew from five in 1970 to 43 in national and private municipal universities by 1980. Computer science is now being taught in all the technological universities in Turkey, and all engineering students as well as some from other disciplines, receive obligatory training in computer science.

38. In Ireland there were 29 specialised courses in the computer science area available at seven third level colleges in 1981. That same year about 5,000 students took modules in computer science at Irish institutions as part of their overall training in other areas, mainly science, engineering and commerce. The University of Linkoping in Sweden has a special "Computer science and technology line" where computer science is the main part of the education - one of several lines leading to a "Master of engineering science." This program is unique in Sweden.

39. Another good example of the rapid growth and restructuring of professional education is in Scotland where computing modules are included in Higher Diploma and degree courses wherever relevant (some voluntary, some not). Thus, report Scottish authorities, all engineering students would have a course in computing, and many science and business studies students would have similar courses. They

also report that the numbers of students taking computing modules and full computing courses have increased rapidly in the last five years. The total intake has probably doubled in the last three years and the demand for places in degree courses (both in colleges and universities) is such that the entry qualifications are steadily rising. Indeed, in Scottish universities the entry qualifications for computing and for microelectronics courses are starting to rival those of medicine and law.

40. In the United States where 90% of all colleges and universities either have their own computers or access to others, all types of institutions, public and private, two-year and four-year, offer courses and degrees in computer science. Enrollments are growing due to demand from business and industry for such students. Computer courses are also a standard part of the curriculum in such fields of study as statistics, the physical sciences and engineering. NIT are also used extensively in American colleges and universities to deliver professional continuing education. A recent survey (13) found their use in such programs as allied health, medicine, engineering and high technology, business, education, law and real estate.

41. In fact, the United States also has a number of good examples of the use of NIT other than computers for professional education. One of these is an association of 17 universities in the Dallas-Fort Worth, Texas area, the Association for Higher Education of North Texas. The Association operates the TAGER Television network, the largest closed-circuit higher education network in the U.S. It offers courses, 85 percent of which are graduate-level engineering, business, and computer science courses for credit. TAGER has developed a hybrid distribution system using ITFS broadcast, point-to-point microwave, cable, satellite, videocasette and telephone and has a unique organizational structure that shares governing powers between the local communities (two-thirds) and the higher education institutions participating in the program (one-third). The TAGER Network combines complex technology and low-cost video production to serve highly motivated learners in professional fields.(14)

42. In general education, the use of NIT has not been so widespread in the various OECD Member countries. Colleges and universities have concentrated their efforts initially - for equipment, for faculty and the development of new courses - in the revision of their professional education programs. Nevertheless, a number of countries report the use of NIT for education of non-specialists.

43. In Finland the Ministry of Education states that computer science is a compulsory subject at the stage of general studies (first year) for students in mathematics, natural sciences, and economics, and at the stage of advanced studies for students in social sciences, education sciences and physical education. In Britain the UGC has recommended that all undergraduates should have some education in the use of computers, report authorities there, since the UGC "feels that the spread of computers into everyday life needs to be accompanied by

an understanding of what they can and cannot do and by an assessment of social problems arising from their use."

44. Some universities in Japan have computer centers specifically installed for educational utilization, and the teaching of computer utilization skills to non-specialists is rather widespread. In the United States a number of colleges and universities have gone as far as requiring all their entering students, regardless of field of study, to purchase microcomputers, with the cost (discounted) usually being included in the tuition charges. The expectation at these schools, which are mostly private universities, is that the students will use their micros for at least part of their work in all their subjects.

45. Beyond computers, higher education institutions in America use other NIT in liberal arts curriculums. For example, Rio Salado Community College (Phoenix, Arizona) has no campus but offers classroom courses in lower division general education and liberal arts as well as occupational programs to over 2,000 students a year. The school uses public and commercial television, cable television, its own public broadcasting radio station, audio teleconferencing, slow scan television, video and audio cassettes and telephone to serve its students. And one of the United States' most futuristic programs is at Columbus (Ohio) Technical Institute where undergraduate liberal arts courses are offered using live, interactive cable television together with videotape. The system is called QUBE, and during the interactive sessions students viewing the television course can respond to questions posed by faculty by pushing buttons on a hand-held keypad device. Student responses are relayed to a computer in the television studio which summarizes responses for faculty immediately.(15) While extremely innovative, the QUBE experiment in Ohio has not yet been duplicated widely elsewhere in the U.S.

46. Expansion of educational mission through use of the NIT is perhaps most visible in OECD Member countries where distance learning institutions have been established. Following the lead of the British Open University, a significant number of countries have agreed that educational outreach is a new but important mission for their higher education system. While substantial numbers of students are not yet involved, the NIT play an important role in these types of institutions.

47. In Germany at the Fernuniversitat, in Finland, in Norway through the Norsk fjernundervisning, in Canada, in Australia at Deakin University, in the United States, in Japan with its forthcoming Broadcast University of the Air and in the Netherlands where the new Open University is expected to open this year - all these universities use a variety of NIT to reach students.(16) Many of these students are adults, working or homebound who would not otherwise be able to participate in higher education. Two of these distance learning institutions are worth describing in some detail.

48. The Fernuniversitat in Hagen, West Germany opened in 1975 and enrolls some 23,000 students, both full time and half time. Like all the other universities in Germany, it is a State university and is made up of faculties in Educational and Social Sciences, Economics and Business Administration, Mathematics and Computer Science, Law, and Electrical Engineering. The course and examination structure corresponds to that of conventional universities in West Germany. The predominate teaching medium remains printed or written materials, but audio cassettes and televised courses are also used. In regional study centers students can also use specially developed recordings and video tapes, and the university has recently begun a videotex experiment.(17)

49. On the other side of the world is Deakin University in Geelong (Victoria) Australia. Officially opened in 1977, Deakin serves on-campus students as a regional university as well as off-campus students (who number about 3,500), approximately 60% of the university's student population. Deakin uses microcomputers, telephones and satellites in innovative ways to serve students off-campus and to manage their instruction.(18)

50. While still not numerous relative to the total number of colleges and universities (and unlikely ever to become so) the distance learning institutions nevertheless represent a significant departure, serving students (mainly adults) off-campus in new and innovative ways. Their emergence is due at least in part to the availability of the NIT which permit new modes and methods of off-campus learning. Their existence in many European countries and their utilization of the NIT capable of reaching across country boundaries has prompted at least one expert to suggest establishing a commission to study the formation of a European Open University Network, noting that "the difficult economic situation in which virtually all Western European countries now find themselves, requires greater efficiency and collaboration in the domain of education."(19) He suggests that such a flexible structure of cooperation will be needed in the next decade as technological developments draw the various members of the European community closer together. Of course differences of language and higher education systems must also be addressed. Networks are discussed further later in this paper.

2. Developing New Educational Functions

51. NIT have potential to change the very nature of the educational instruction process as well as the methods used to "manage" or administer the instructional system. When computers are used as the tool, these new functions have been labeled, respectively, "computer-assisted instruction (CAI)" and "computer-managed instruction (CMI)." The word "potential" is used quite deliberately here, because available research has largely been able only to hint about the usefulness and quality of CAI and CMI. Neither is reported in wide use as yet among institutions in OECD Member countries. Whether or not either will be adopted to a greater extent over the

BEST COPY AVAILABLE

next decade is presently a matter of speculation - dependent on such variables as cost, perceived quality, and effectiveness.

52. Regarding CAI, the Netherlands provides a good example. According to one report (20), CAI (as well as CMI) is used in more than thirty courses at 12 of the 14 universities in the Netherlands with about 6,000 students participating. According to this study, "An initiative of five universities to purchase a dedicated CAI-system and operate this in cooperation has not (yet) succeeded..." due to various institutional and government budget restrictions. Present CAI efforts have been assessed, in terms of quality as falling "very far short of its potential." Cost comparisons included in this Dutch study of CAI versus traditional instruction show CAI costs per student contact hour to be substantially more than costs of traditional instruction unless relatively large groups of students participate.(21)

53. Elsewhere, a number of countries (Belgium, Luxembourg, Sweden, Finland as well as the Netherlands) have experimented with an American CAI system - PLATO - developed by Control Data Corporation in conjunction with the University of Illinois. These experiments have been generally limited and short-term in nature with little widespread impact or priority. PLATO continues to be used as a CAI system (with substantial amounts of higher education courseware available) at a number of United States colleges and universities.

54. More extensive use of CAI is reported in Great Britain where "impressionistic evidence confirms CAI is becoming more widespread in higher education." It is used extensively in the operations of the British Open University where they see great long term educational potential because of CAI's interactive ability for individual students, its capability of patient, instant feedback, its simulation potential and its communication and database capability enabling students to access information quickly.(22) This study also notes, however, the substantial costs of CAI (not so much for hardware where costs are falling, but for educational software where production costs are rising) as well as the problem of quality ("studies demonstrate that CAL (CAI) can be used effectively to supplement existing education provision but much of the CAL that has been created has not been educationally effective at all and has been discarded.") (23)

55. In Scotland all higher education institutions are reported to have CAI equipment, and in Japan it is used extensively in the national technical colleges. Italy also reports slow progress but growing interest, especially in university-based research projects on CAI (at the Universities of Milan, Genoa, Naples, Catania and Bari). So far, however, it is evident that regardless of its potential, CAI is being viewed very cautiously in most countries and adopted slowly if at all. More research on the effective use of CAI is now underway in such places as the Institute for Computerised Learning Environments at the University of Stockholm, the Computer Assisted Learning Research Group at the British Open University, and the Computer Assisted Instruction Laboratory at the University of Paris VII.

BEST COPY AVAILABLE

56. Similar findings regarding extent of use apply to CMI, as well. Few countries report its extensive use in higher education institutions. Again the potential is substantial. According to an American study,(24) CMI can accomplish a great deal without requiring computer access by the student. This study notes CMI's abilities to: "present alternative goals that students select to determine their learning paths; continuously monitor and assess how much practice a student requires, how well information is retained, and what methods of study work well; use previous performance data to prescribe , specific methods of study or testing; and provide the instructor with group and individual statistics to help in the revision of course materials."

57. Specific examples of CMI use do exist in Member countries. In Japan SIS-TEM III, a computer-based educational system, has been developed at Gifu University. It is designed for management of teaching and learning items, administration of student data and for all-inclusive utilization of computers in school education. (25)

58. CMI is also utilized at several of the distance learning institutions. At Fernuniversitat in Germany, computers are used to correct and grade students, and similar systems (sometimes interactive) are in operation at the British Open University. In Canada, TV Ontario has a computer-managed learning system (RSVP) which was originally developed and still is in use at an American community college (Miami-Dade Community College, Florida).

59. If and when CAI becomes more established in higher education institutions, it is probable that the use of CMI will also increase, since the two systems work well when linked together. But until that time, widespread use of CMI remains unlikely.

3. Searching for "Courseware" and Other NIT Uses

60. The lower costs for NIT hardware over the past few years have contributed to their increased use at higher education institutions in most Member countries and sent faculty and administrators on a search of educational materials to be delivered via these technologies. In the case of computers, these are usually called "software" or "courseware." Problems are being experienced across most Member countries and seem to fall into the following categories:

i) availability, including machine compability and cost of production problems;
ii) quality problems, including questions concerning choice of mechanism for which courses for which students;
iii) higher education's role in developing courseware;
iv) does the medium change the message, and how do people learn; and
v) other uses of NIT in higher education.

i) Availability

61. In terms of availability, most countries report severe shortages of (good quality) software for computers and televised programing, videotape courses, etc. for the other NIT in use at colleges and universities. In part this is due to the problem of machine compatability. In the case of computers, software developed to run on one manufacturers brand of machine will not usually work on another. Institutions of higher education investing in computers produced by one company often find themselves dependent on available software written specifically for that computer, unless some enterprising professor or student has taken the (considerable) time to rewrite the software's program so as to make it "compatible." This problem results in endless time wasted converting existing programs to run on other machines (or simply writing ten different programs to run on ten different machines).

62. The effect of all this lack of machine and software standardization is to limit severely the amount of available software. This is true whether the country's institutions rely on the open market to purchase their machines (Great Britain, the United States) or whether the national government of the country promotes the use of single, nationally-produced machines (which can't accept software written for other machines either) as in France. And since the universal truism that time means money must also apply in this case, the cost of this compatability problem is tremendous.

ii) Quality

63. Availability of software and courses using other NIT is also limited by the problem of quality. Much of what is available is simply not very good by anyone's standards. Examples exist in many Member countries of courseware tested and rejected on quality grounds. "Electronic page-turning" charges the United States Secretary of Education, with similar criticism heard often elsewhere. More subtle problems also exist. Very preliminary research suggests that the "role accorded to certain media in the teaching-learning process also depends on the educational level and other social characteristics of the target group and not merely on the subject matter and the potential of the medium itself."(26) What is quality courseware for one group of learners might not be appropriate for another group at a different educational level. This issue is just now being explored in research conducted in several countries and definitive results are not yet available.(27)

iii) Higher education's role

64. Higher education's role in the development of software, courseware, and other materials for the NIT is generally deemed to be crucial. In some countries, research organizations and centers located

BEST COPY AVAILABLE

at colleges and universities are working to prepare educational courseware, but in other countries individual professors at higher education institutions are the only ones working on such development. Scotland's response is fairly typical here. In terms of software creation, Scottish authorities report, "This is less organized than in the school sector, mainly because software has been written to identify closely with courses offered in individual establishments, and as these tend to vary from one college to another, so the software is tailored to meet the local needs."

65. Sometimes there are limited software exchange systems in operation among colleges and universities, but as is pointed out in the Scottish response, "the quality of the materials is very variable, ranging from small programs written for particular purposes by an individual to well documented technically sound packages...(while) some are more complex, involving interfaced equipment including interactve video tape and video disc."

66. In some other countries the role of higher education in the search for educational materials has several different aspects. In the United States, for example, while considerable amounts of courseware, televised educational programming and the like are produced by colleges and universities, a recent survey revealed some 700 private-sector firms engaged in education software development. Much of this software produced privately is directed toward the elementary and secondary education levels. Still, some is used at colleges and universities. In response a number of higher education institutions have assumed the role of courseware "evaluators," assessing the quality of this privately-produced software, occasionally with public support. Harvard University is an example here (as is the University of Edinburgh, Scotland, which has a more comprehensive evaluation contract from the Scottish Education Department).

iv) Does the medium change the message?

67. A much more limited number of institutions in Member countries (Great Britain, Canada, the United States) are seriously addressing the question "does the medium change the message" - a significant matter. How does (should) the content of a course offered via television, for example, differ from the same course offered in a standard classroom setting, if in fact it differs at all? It can be expected that, as the new technology is introduced into the learning environment, so the course content will be in some way changed or modified. A Canadian study for the OECD is a good example of work being currently done in this area.(28)

68. Interestingly, this study found that educators when addressed this question responded that "it does not or should not make any difference. In instances where instructors recognized that the 'medium' does affect the 'message' they found it difficult to specify in what ways the curriculum changes." The study goes on to conclude

"...it appears that the change of the medium of delivery does make a difference to the content of the curriculum, but that this area is not yet clearly understood. It is not necessarily that the medium affects the message, for generally the same information is transmitted regardles of medium, but that it changes the process of communication in terms of the mental skills needed to understand the message, and the relationship between the participants."

69. This introduces the deeper question of how do people learn, a topic far beyond the scope of this paper. But it is clearly a very important question just beginning to be addressed in the context of the NIT and higher education learning. Finding the answer(s) will be a complicated research process but one which must be continued as the search for educational courseware to be delivered via the NIT goes on.

v) Other uses of NIT

70. Finally, it is worthwhile to consider what other sorts of materials are being offered on higher education institutions' computers and other NIT. Three areas should be noted: provision of student counseling and advising; provision of access to broad information and data bases; and inter-institutional networking systems.

71. Beyond delivery of actual courses, colleges and universities are using the NIT to a limited extent to provide such student services as advice and counseling. Computer-assisted counseling is an interactive process where the computer is used to present information, solicit and monitor responses and select and present additional information in accordance with individual client needs. There are several American examples here. Online career information and guidance systems are sophisticated tools available to counselors to help students, and are used at a number of colleges and universities. Some which are available, such as CHOICES, CIS, COIN, and GIS, provide online information storage and retrieval where the user has interactive, structured (but non-threatening) interviews with the computer.

72. Other systems, such as DISCOVER, EXPLORE, and SIGI, deliver significant amounts of guidance content beyond career information. They provide simulation, exercises in values clarification, decision making, classification of occupations and help assess the current status of career development.(29) The PLATO system, described above, is also used in the United States to provide student guidance, notably by the city of Baltimore, Maryland.

73. Computer-managed counseling, which is not interactive, is also used. Even if computers are not available for direct client use, counselors can use them for clerical and administrative tasks so as to reduce their paperwork loads, freeing them to spend more time with individual students and to administer capably large student populations. Fernuniversitat, the distance learning institution in

Germany, uses computers in this way.

74. Concern has been expressed about dehumanization of the counseling process, potential loss of confidentiality, and a tendency for students "to interpret the objectivity of the computer as evidence that the information obtained is completely valid and reliable." Yet, these new techniques show great promise in their tremendous capacity to store and retrieve as well as to select, sort, and combine information quickly, accomplishing tasks that are humanly impossible.(30) Their use may well become more widespread at colleges and universities in the future.

75. The capability of the NIT to provide immediate and comprehensive access to a broad range of information and data bases for both students and faculty is already having broad impact on higher education in those countries where such systems are available, notably Japan, Canada, the United States and Great Britain. Japan provides a number of examples in this area. The University of Tokyo Computer Center has developed a consolidated academic journal catalog data bank (TOOL-ULP), and TSS interactive search access is possible from anywhere in Japan. Gifu University has developed a Japanese language data base which contains nearly 100,000 references in the fields of educational technology and educational psychology, with the resulting information also available at the Universities of Kyoto, Osaka, Tsukuba and other places. A similar, broad-based data system, DIALOG, has been produced and is maintained by a private business in the United States and is widely available on American college campuses through the school library.

76. The same OECD Member countries noted above are in various stages of experimentation and operation of another NIT, videotex, which is being tested by a few colleges and universities. Videotex allows the home television set to function like a computer terminal and retrieve text information and graphics from a remote database. Since 1977 the Japan Telephone and Telegraph Corporation has been conducting experiments aimed at the development of CAPTAIN, an interactive videotex system which utilizes the telephone to transmit information into the home. CAPTAIN service is scheduled to begin in April, 1984. The Japanese are also experimenting with VRS (Video Response System). Since the CAPTAIN system relies on the public telephone network, it primarily involves written and graphic displays. VRS, however, will have its own dedicated circuits, making it possible to furnish moving images and audio information as well. It doesn't take too great an imagination to visualize the educational capability of such an interactive tool, but VRS is on the leading edge of experimentation and not actively used to provide higher education.

77. Operating videotex systems are being used by colleges and universities, however. In Canada, the University of Manitoba uses the Canadian videotex system, TELIDON, to deliver distance education. In the United Kingdom, the PRESTEL system provides access information about colleges and universities.(31) At present videotex has little

widespread impact on higher education institutions, but its use may grow in the future.

78. Computer networks are in operation in a number of Member countries. British authorities report many connections between their universities where most are connected to one of the two National Centres at the Universities of London and Manchester. There are also regional networks interconnecting the universities in particular geographical regions. The interconnection is carried out by dedicated lines, hired from British Telecom. Universities use these communication links for access to the large computers in the National Centres and also for access to expensive software packages and large data bases. They also report that a development plan has been drawn up so that connections can be unified to incorporate all universities and research council institutes.

79. In the United States, higher education computer networks are reported to be "growing in an uncontrolled, almost chaotic manner to support the expanding needs of scholars and administrators...."(32) Such networks are being used for resource sharing and communication among academics.

80. As with videotex, however, the use of such inter-institutional networks is concentrated in only a few Member countries at present. Because of the cost advantages, however, it can be expected that such networking activities will spread in the near future.

4. Strengthening Research

81. In the area of research, use of NIT has had a major impact on higher education institutions in nearly all OECD Member countries. First, the increasing amounts of computer equipment available to faculty at colleges and universities has generally spurred research efforts in many fields. And now that major data bases are more accessible via computers and the data itself more easily manipulated, academics in most disciplines are pursuing more sophisticated research topics than would have been possible previously.

82. Some institutions in the United States (Stanford University, for example) make microcomputers available to all faculty members, to conduct their own research at home or wherever they desire and to communicate with one another and with the university's mainframe computer system whenever necessary. The growth of computer networks in America has also been encouraged by individual faculty in specific fields of study, seeking to improve their own research capabilities and to communicate with their colleagues. Similar activities are occurring elsewhere.

83. Second, colleges and universities in most Member countries are in the forefront of research concerning the use and effects of NIT in education. For example, the majority of the specific research programs described by Morris in his discussion of the use of NIT in Scottish

education (33) were being carried out at Scottish higher education institutions. In the Netherlands the Centre for Education and Information Technology (COI) has been set up at the Technical University at Twente. Funded for a five year period, COI has a broad mandate of research and provision of information. Similar work is being done in nearly all countries, predominately in colleges and universities. France is the exception here where much of the research work on NIT in higher education is being done in separate research centers.

84. Unfortunately, recent cuts in research funding in many OECD Member countries have hurt severely. In a number of countries the government sponsored university-based research on higher education and the NIT. For example, the National Institute of Education and the National Science Foundation have both funded a number of research projects in the United States at particular colleges and universities. But such government research funding is declining. In Germany, the budget for all data processing projects under the federal Ministry of Research and Technology was 344.1 million DM in 1979, but had declined by 1982 to only 52 million DM.(34)

85. At least partly in response to the cutback in government research support and partly in response to other pressures, colleges and universities have begun to seek research support from business and industry. Such privately-supported NIT research is becoming an important factor in institutional budgets in a number of Member countries (Scotland, the Netherlands, Japan, the United States) The increasing number of relationships between higher education institutions and business will be discussed further below.

86. Overall, despite budget reductions, a substantial amount of research is being conducted, both about and using the NIT thoughout most OECD member countries.

5. Identifying The Faculty Role

87. Certainly faculty play an integral role in the development and delivery of courses, programs, and counseling provided using the NIT. Yet, studies in the United States and Canada have shown that many faculty participating in distance learning programs were teaching only part-time, and holding other jobs separate from their academic positions.(35)

88. The extent of faculty involvement in NIT curriculum development appears to be the result of a combination of conditions: the extent to which existing materials are used, the expectation that other faculty from the same (or other) institutions must be involved, the types of NIT used to deliver the instruction, and the relevant skills that the faculty member brings to the process.(36)

89. LeCorre and Schwartz note that, "at present, courseware is implemented largely by "amateurs", e.g. by middle-school teachers or

university professors, expert in some educational subject area, but new to the computer medium...."(37) These authors go on to describe the "compelling instructional style that the new technology affords," through the combination of many talents. The ideal situation, as they see it, would be to have a group to develop such courses which would include "a scholar deeply versed in the subject to be presented ...who must also be a talented and sensitive teacher.... These academic skills must be combined with the skills of graphic designers, with the image-oriented, "filmic" skills of the motion picture director, ...with actors able to read passages of text,...film clips, and in some cases the services of animation studios.(38)

90. Little wonder that some of the more "traditional" academicians blanche at the thought of educating students via the NIT. Some of the techniques and skills required are so foreign to those they have used in the past as tutors or classroom instructors. In the British Columbia study cited earlier, educators who were questioned about the satellite television delivered courses in use there said they felt such courses were "improved, being better planned, prepared, organized, structured and presented than the average lesson delivered in a regular class."(39) 'The use of this NIT required more organization, more advance planning and significantly more preparation time than would be required to give a typical class.

91. Examining patterns of faculty involvement and faculty resistance to use of the NIT in America, Lewis found consistent problems of faculty resistance to the use of telecommunications for instructional purposes in the programs he surveyed.(40) This study found some faculty who resist any sort of change, some who object specifically to certain aspects of the NIT (it's impersonal, it diverts resources needed elsewhere, it threatens my job), and some who simply feel uncomfortable because they are unfamiliar with the technology. Similar findings of faculty attitudes can probably be found in other OECD Member countries.

92. However, this survey identified a number of strategies that can help to overcome faculty resistance, strategies that have been used effectively at American colleges and universities. These include: providing for active oversight by departmental faculty; encouraging participation of prominent faculty in the project; utilizing full-time rather than part-time faculty as much as possible; using the NIT in the least complcated and least obtrusive way; targeting use of the technology to save time for faculty members; and offering an effective orientation program to participating faculty.(41)

93. Faculty acceptance and effective utilization of the NIT is an important part of the implementation process as higher education institutions adopt various kinds of these new media. The challenge for both faculty and institutional administrators is not an easy one, and it is clear that faculty must be centrally involved as the NIT are tested and installed on campus.

C. The Influence of Industry

94. Interaction between business and universities exists in most OECD Member countries. This interaction takes on special importance in the area of NIT as governments seeking to improve economic conditions and gain a place in the "third industrial revolution" directly or indirectly encourage close relationships between higher education and business.

95. At the same time, increasing budgetary restrictions and financial pressures placed by governments on colleges and universities force them to search for outside, additional sources of support. And business and industry, especially firms involved in the manufacture of NIT and the provision of related services, look more and more to higher education as a source of trained manpower and relevant research as well as a provider of services and a market for computers and other NIT.

96. This general topic is discussed in detail in the recent OECD study on new forms of cooperation and communication between industry and the universities.(42) Only a few aspects of the impact on higher education will be noted here.

97. Government efforts to encourage industry-university collaboration in the area of NIT technologies have been especially evident in the United Kingdom, Japan, and the Netherlands. A good example is in the Netherlands where, by order of the Ministry of Education, the Ministry of Economic Affairs, Philips and Control Data Crporation (Netherlands) will work with the Educational Research Center at the University of Leyden to conduct research on applications of the videodisc in combination with the PLATO CAI system.(43)

98. Colleges and universities in many countries are beginning to initiate contact (and subsequent contracts) with business, as part of ther fundamental mission in teaching, research and service, and motivated further by a need for additional revenue. The efforts of Rensselaer Polytechnic Institute and Brown University in the United States are often cited as good examples of institutions reaching out to industry in furtherance of common goals.

99. Examples where industry has taken the primary initiative to link with higher education occur as well. In some cases this industrial initiative is taken with a view to meeting immediate manpower needs. In Japan and the United States a different sort of effort is also underway, involving substantial donations (or discounts) of equipment to colleges and universities. The motivations of industry in this sort of program are usually mixed, but include the desire to establsh a market for their technology products on campuses as well as to encourage research. The Apple University Consortium (AUC) in America is a good example of this sort of arrangement. The AUC, which consists of 24 major universities, expects to place 50,000

microcomputers manufactured by the Apple Computer Corporation on its campuses by the end of 1984. Member institutions are expected to purchase $2 million each of Apple products at varying discounts over a three-year period. The plan is for students and faculty to use the computers for developing curriculum and new applications. Each university is required to develop instructional software on Apple computers and to meet regularly with other AUC members. Joining the consortium gave participating universities the opportunity to purchase the computers for significantly less than the retail price.

100. Whatever the source of the initiative, relationships between business and higher education institutions in the area of NIT are expanding in most OECD Member countries, with significant impact at a number of colleges and universities. In all likelihood these arrangements will continue to grow in the near future.

Section II

ISSUES FOR THE FUTURE

102. Given the trends of NIT introduction into higher education institutions, what public policy issues must be resolved in Member countries? What are the major questions still facing colleges and universities? The following sections of this analysis will consider these remaining questions - not so much with the notion of providing definitive answers, but instead with the hope that by raising these issues, enlightened debate can result.

A. Public Policy Issues

103. The previous chapter described current policy planning activities for NIT and higher education - the situation in a state of flux, and not a little influenced by the broader economic and political context. The focus of policy development, where it has occurred, has generally been on secondary, not higher education.

104. An important question here, then, is whether or not Member countries should now adopt a separate, specific policy (or series of policies) regarding NIT and their implementation in the higher education sector. Is it time to focus on higher education in these matters? Are the issues and concerns discrete enough for governments to be able to address them separately?

105. The questions are not easily answered. In France, higher education has been integral part of the broader NIT policies developed. In most other countries where some educational planning has been undertaken at the higher education level, however, such policy efforts have often been related only tangentially to planning efforts in other education sectors. And in a few countries (Sweden is an example) with extensive policies for lower education levels, little higher education planning has taken place at all. What are the merits of integrating higher education planning efforts into the broader educational policy development process?

106. Responses, of course, must differ depending on the current status of planning in each country. In countries where little or no planning has been undertaken at the national level (Germany, United States, Canada) the question may well be moot. In America, for example, Congressional attempts to enact various laws regarding higher education and NIT (the so-called Apple Bill and others) have not yet

been successful.

207. It can be argued that the purposes of goverment policymaking and funding for the various educational levels differ, and therefore can be addressed separately. Support for professional education (computer science, engineering) at the postsecondary level is usually designed to meet short-term manpower needs. Secondary education programs use NIT, but have quite different and broad goals for the long-term. But such arguments are probably too black and white. Governments fund technology programs at secondary schools with manpower requirements in mind, and support planning activities directed toward higher education with a view to improving the broad notion of education and learning. Separate goals and purposes for government policies at the different levels are blurred.

208. And, it is difficult to argue against the virtues of coordination and integrated planning, especially in the cases of those countries where bits and pieces of policy development have occurred so far. Commissions here, planning and advisory groups there - all studying and reporting on different aspects of the problem for different educational levels can only lead at some point to a babble of advice, sometimes conflicting. Perhaps the time has come for more coordinated policy development.

209. In some countries that might mean beginning (or emphasizing more strongly) a consideration of higher education's role as planning for implementation of NIT at other educational levels continues. In some countries it might mean stepping back to get a good overview of disparate activities in all educational sectors, with consolidation and coordination of efforts a logical next step. And in some countries it might mean rethinking once again the policy decisions made earlier to have little or no policies at all.

210. Italian officials, for example, note that "the political authorities responsible for education...have been particularly active in implementing interesting and varied ventures in the past, and are continuing to do so. As of this time, however, there seems to be no overall strategy that might impose at least some order and set overall goals for all this effort. This is likely to be the task before us now as a country...."(44)

211. As a part of this policy re-evaluation process, governments in Member countries will probably want to consider the following issues. Who should be the main agents of a national policy regarding higher education and NIT? Should it be ministries of education (perhaps in some form of cooperation with ministries of industry), state or regional authorities, local groups, or the higher education institutions themselves? What should be the divison of labor, and what degree of centralization or decentralization is required?(45)

212. A second public policy issue relates to the focus of support. Higher education institutions have up until now, concentrated on

professional education as the main area for NIT introduction. Should this educational mission of colleges and universities continue to receive the most emphasis in policy planning and governmental funding, or should more attention and monies be directed toward spreading the use and study of NIT into all fields of higher education study?

113. Third, what should be the role of central government regarding higher education and NIT? Several options are listed below which have been suggested as possible governmental roles:

- monitor developments in higher education institutions and elsewhere, including data collection, trends analysis, and other similar activities;
- assist in the setting of standards, possibly including machinery, software, communication protocols, etc.;
- perform evaluation functions, of higher education programs, software, courses, or learning itself;
- provide research support to colleges and universities (or elsewhere) for NIT studies relating to higher education;
- provide support for manpower training (teachers, professionals, technicians) in higher education institutions;
- provide support for general education about and/or using NIT to higher education institutions;
- provide support for equipment purchase;
- provide incentives to foster industry-university cooperation in the area of NIT;
- encourage cooperative efforts among institutions themselves, and between institutions and governments at all levels.

114. Depending on the options selected, governments can take a strong stance with regards to policy development and subsequent program support, or choose to adopt a lesser role, relegating some of the authority and responsibility to others (such as to other levels of government or to the higher education institutions themselves).

115. OECD Member countries have already begun the process of selecting and implementing options from this list. Irish authorities are encouraging close collaboration between higher education and employers, and "innovation centres and Micro electronics Application Centres have been established with some third level institutes to assist existing industry and entrepreneurs to develop" by using NIT.

The Netherlands' government is actively promoting inter-institutional cooperation. Evaluation and assessment will be important upcoming activities, report officials in the United Kingdom.

116. A fourth important issue must be addressed at the policy-making level - that of equal educational opportunity. In many OECD Member countries there are population groups which for various reasons (geographic location, income, race, previous levels of educational attainment) have been denied to opportunity to participate in higher education. The NIT have been mentioned by some as having the potential to lower barriers to participation for such groups, - easing their transition into higher education programs, providing distance education in the home or community center, etc. A recent American study has examined the potential of NIT in this regard and found it to be substantial. However, it seems clear that central government will have to take the initiative for support of policies and programs in this area, since higher education institutions themselves appear unlikely to have the incentive or the financial wherewithal to establish such educational opprtunities utilizing NIT.(46)

117. The recent efforts of the Finnish government to bring higher education to outlying regions are a good example of what strong policies can accomplish in this area. Also, the distance learning institutions established in a number of Member countries see improving access as one of their more important goals.

118. An overriding factor in all of this policy development process is that of costs. In most Member countries, the financing of these various policies and programs remains a major issue. Where will the money come from? With tight budgets and limited resources, the substantial costs of implementing a NIT initiative in the higher education sector will make any government pause and perhaps reconsider. Micros at every college, satellites in the sky beaming educational TV, videotex systems on a national scale - the financial resources necessary will be tremendous.

119. Understandably, government budget officials ask, "What are the benefits in relation to the costs?" While it is possible to make reasonable estimates of the costs of various policy alternatives, it is nearly impossible to estimate benefits. Too little is known at the present time about the value of learning via NIT compared to more traditional modes of education to permit such estimations, or about calculating the value to society of something such as 'computer literacy.'(47)

120. It is not even clear that government investment in manpower development by higher education institutions for specific economic sectors (such as high technology) pays off. (This issue will discussed further later.)

121. Thus, government officials in Member countries are often forced, when making decisions regarding higher education and NIT

support, to invest blindly in hope of significant return at some point in the future, but with no assurances and no guarantees. The risks are enormous.

122. Unfortunately, the risks are just as great if blind investments in such efforts are not made. And it is obvious that governmental decisions in this area are developed in a much broader context than just the education arena. The social and political context of each country comes to bear on the process, shaping policies in unique ways.

123. Certainly most governments will search for ways to share the costs and spread the risks. Some countries (if not all) will require colleges and universities themselves to bear at least part of the implementation costs. Some will seek to share the costs with regional and local authorities. And some, like the United States, will leave a major part of the initiative to private enterprise and to individual students who must purchase their own equipment. The magnitude of the total costs involved virtually dictates that Member country governments seek shared and perhaps innovative financing mechanisms.

124. It will be years before many of the critical policy development questions are resolved, and governments are wise to realize that the NIT implementation process for higher education will undoubtedly be drawn out over a much longer period than originally expected by even the most thoughtful observors.

B. Institutional Issues

125. Despite the substantial impact NIT introduction has had on all aspects of college and university systems - mission, functions, educational material, research, and faculty - much potential lies ahead with many inherent issues and problems.

1. Expanding Mission

126. Professional education, attractive from an institutional viewpoint as meeting government and societal demands for technical manpower and attractive to students seeking readily available jobs, has been in the forefront of higher education's initial response to the advent of the NIT. But is this the way of the future? Should it be? This is an issue which needs to be addressed by institutions as well as by governments.

127. The higher education sector has had difficulty responding in the past to short-term manpower needs in many countries. The problem is partly one of time lag. Demands for manpower in specific economic areas develop. Colleges and universities respond. It takes a year or more to develop a responsible curriculum (and get it approved). It takes two to four years to enroll the first group of students and graduate them. By the time significant numbers of trained college graduates actually reach the workforce, the demand for manpower in

that particular area has often slackened or shifted. Other sectors, able to move more quickly than the higher education system, have filled the demand (including short-term institutes, training programs already located in business and industry, etc.). In some cases the manpower forecasts on which the whole effort was based were themselves in error. The higher education sector doesn't deal well with such problems.

128. In addition, short-term perceptions of demand sometimes don't fit the long-term facts. It is possible that in a number of Member countries there will be a declining need in the overall job market for college graduates, as is already the case in the United States. Over the next decade in America, for example, most of the jobs available will not be in the professional categories. Occupations producing the most new jobs will be secretaries, nurses' aides, janitors, and salesclerks. Even in high technology job areas specifically, the two categories with the highest expected percentage growth are data processing mechanics and computer operators, neither category requiring a person with a college degree. The coming of the Information Age, at least in the United States, is not going to trigger great increases in numbers of jobs available in absolute terms.(48)

129. So there appears a bleak vision of colleges and universities rapidly gearing up in the United States, and perhaps in other OECD Member countries to train too many professionals in NIT professional fields, often with government support. While the problem may be overstated here and manpower demand will surely vary across countries, at least the issue can be stated this way: Should the major emphasis of higher education institutions remain on training of professional NIT manpower? Would it not be wiser to diversify, as it were? Should it also be acknowledged that while the coming Information Age many bring new manpower demands of unknown strength and duration, it will more assuredly bring profound change to all aspects of society?

130. Education for understanding the implications of these elemental changes may be the more important role for colleges and universities in the next decade. Should not the use of and study about the NIT be integrated more carefully and fully into a wider range of programs offered in higher education institutions? Students could be prepared broadly for the world of work - not so much for any particular job category but more liberally to provide them with flexible skills to cope with a rapidly changing world where use of the NIT will be ubiquitous.

131. The expanding mission of higher education might also utilize the NIT more fully to reach out to 'nontraditional students' - working adults and others who will need and demand new skills and new training in an evolving work environment. As shown by the various distance learning institutions already in operation, the NIT appear well suited to assist other, more traditional higher education institutions to reach potential new students, thereby improving educational

opportunity for certain populations and possibly offsetting declining enrollments of younger students to at least some degree.

2. Searching for Content

132. Of all the important issues facing higher education about the NIT, one of the most crucial must be answered by colleges and universities themselves, through their research, their experiments, and their experience. The issue can be phrased this way: do the NIT make a difference? Can they be used to improve education - the transmittal of knowledge and understanding? Does their use in teaching help people learn in ways that are significantly improved over traditional methods?

133. The search for answers to these questions must be pursued vigorously in the next few years, for why else are institutions implementing all the NIT if they don't make significant improvements? Given the vast sums being invested, there is a certain urgency about the search for answers, hopefully positive! It is one thing to take risks and invest blindly before machines and techniques are proven, but it is quite another to forego the subsequent 'proving.'

134. Alternative mechanisms (various kinds of computers, television, videotape or videodisc, etc.) abound and can be used in endless combination. Content can be well developed or of poor quality. Certain courses or fields of study may (or may not) lend themselves more readily to devlivery via the NIT. For example, it has been suggested that remedial courses and scientific courses relying on graphics and simulation are particularly well suited to presentation using computers or other similar mechanisms. Is this true? Certain groups of students may be better served using NIT, some suggest, while others point out the new media work particularly well for distance education. Then there is the basic question - to what extent is human interaction necessary for effective learning? This issue has been raised since the advent of courrespondence courses, but must be studied anew in this new context.

135. Society as a whole must rely on higher education institutions to study all these variables and to demonstrate what works best and what provides little if any improvement given the cost. Quality of the educational software is an important factor here, since it will do little good in a research sense, to test the effectiveness of the NIT using poor quality content.

136. All the above discussion is not meant to suggest that higher education has not yet even begun the task of proving the NIT's worth. Limited amounts of research and evidence from demonstration efforts are beginning to appear. But much more needs to be done before educators and others can feel satisfied that the NIT will in fact improve higher education.

137. Another point must be emphasized. The issue has been framed

thus far in terms of effectiveness of use. But a related issue must be addressed. Will the study about NIT by students in colleges and universities improve their overall "education"? Computers and the other mechanisms will play an increasingly important role in everyday life over the next decade in most OECD Member countries. How much should college students study about this phenomenon? Again the question must be raised in many fields of study - sociology, anthropology, economics, to name only a few. The world is growing smaller as NIT are used more extensively. Higher education institutions are ideally suited to explore the implications. The potential for change in education curricula is substantial.

138. Based on the assumption that the NIT do have a place in education, colleges and universities must continue to define their role in the production of educational materials, including courseware and additional services such as counseling. Will the higher education sector accept the development role here, or will the initiative be taken instead by government, research institutes, or private enterprise? This issue will undoubtedly be resolved in the next decade.

139. And what is higher education's development role beyond its own sector? To what extent should higher education be responsible for developing courses for primary and secondary education or for other sectors of society - government or business and industry? It can be argued that colleges and universities have a key part to play in developing primary and secondary education programs (as they train teachers) and in developing education and training materials for governments and private enterprise. Again the intent is not to suggest that higher education has not engaged in such activities in the past. Of course it has. The question is one of future level of effort. How much more should institutions be engaged in such development?

140. The pressures for colleges and universities to do more in this area are strong. Institutional Schools of Education seem competent to do that work for lower educational levels. Practicing teachers in primary or secondary education have little time for such efforts. And pressures on higher education institutions to develop learning materials for business and industry have also been strong due as much to the need for institutions to find new sources of revenue as to industry's demands for courseware.

141. So the challenge and the opportunity to take a major and increasing role in content development for the NIT is facing the higher education sector. Will colleges and universities accept the responsibility in the years ahead? Competition is growing rapidly, and institutions must decide quickly what the extent of their role will be, or lose the opportunities to a large degree.

3. Strengthening Research

142. The issues of needed research is inherent in the discussion of

the other problems already noted in this chapter - policy decisions, governmental roles, and effectiveness and quality of courseware.

143. Dissemination of research results is an important issue not discussed previously, however. Studies, experiments, demonstrations and pilot projects are getting underway all over the world concerning higher education and NIT. The mechanisms themselves offer unique and substantial communications potential. Yet there still remains a significant problem of dissemination of results among interested government officials, college educators and administrators, with too much "re-inventing of the wheel."

144. The NIT both call for and present exciting and innovative opportunities of communication on an international scale among researchers and program planners. It is possible to envision a higher education ERIC-type system - accessible in various OECD Member countries - which would go beyond literature citations to include reports of research in progress, results of evaluations and pilot projects, and access to relevant data bases located internally in each country. A college administrator comtemplating the use of CAI at his institution could examine results of its use in another, far-flung college without making the effort a long-term project spent in the libraries of several countries. Will higher education institutions collectively be able to accept the responsibility and establish such a research network on computer? Will governments in Member countries need to play a role? These are questions to be addressed in the next few years.

145. A second research issue which should be raised at individual higher education institutions is the extent to which faculty and students will be provided access to the NIT for research purposes, including access to the emerging computerized data bases. The investment costs are considerable and the question of who should pay will certainly be asked. Many institutions will choose to share the costs among administrative budgets, and faculty and students themselves. But however paid for, new standards of quality for research efforts are beginning to dictate that these tremendous data and literature resources be utilized. Colleges and universities can only expect demands to expand for such research opportunities from both faculty and students, especially as the availability of means of access (micros equipped with modems) increases.

4. Identifying the Faculty Role

146. Higher education institutions must face squarely the issue of faculty resistance to implementation of the NIT and do so quickly. The task is not insurmountable (though perhaps formidable). The previous chapter of this report noted a number of techniques which have proven effective in American colleges and universities. Most would appear transferable to institutions in other Member countries.

147. Beyond these, however, any positive results of the research

called for in the previous pages on the subject of NIT effectiveness can only help soften faculty resistance. Who can blame teachers for hesitating to use mechanisms the value of which is not yet well documented and the use of which requires substantially more time? Certainly there are faculty at institutions in most Member countries who use NIT and use them well. Admittedly there are those faculty members who will never be persuaded to teach via videotape, or whatever. Usage will never be universal. But a basic, positive attitude on the part of faculty must be established at colleges and universities. Lacking such acceptance, effective utilization of these mechanisms will be difficult if not impossible.

C. The Issue of Industrial Cooperation

148. The impact on higher education institutions of industry's interest in NIT is already substantial and growing. High tech industry-sponsored research centers are sprouting at colleges and universities. Equipment donated by companies is being tested and evaluated on campus. Institutions are busy developing high tech training programs for employees of business, to be delivered either at the institution or at the work site. Professonal continuing education programs are expanding. Faculty are increasingly hired as industry consultants. What does all this mean for the very nature of higher education?

149. Surely the old vision of the "groves of academe" far removed from the work of work is fading. Probably this is a positive development, a wise response to charges of unreasonable remoteness from reality that have been leveled at institutions in the past. Clearly the changes are being hastened by economic necessity. Higher education is an expensive enterprise, and there are finite limits to the abilities of students to pay. Research priorities demand costly equipment, and in few areas are the costs as high as in the study and use of NIT. Pressures (sometimes political, sometimes ethical) to provide community service push institutions into collaboration with local industry, as well as desires on the part of educators to provide real world experiences for students.

150. And yet, there is a sense among some viewing the scene that the idea can be carried too far. Nowhere is this more a possibility than in the area of the NIT. It is easy today to visit colleges where the new technology research center is funded by a cooperative effort of ten companies, the microcomputers in use by students are all donated or provided at discount by the equipment manufacturer, and the computer research underway is being conducted by faculty under a government military contract. The question arises: who has control here?

151. Such institutions stoutly proclaim their independence, of course, defending their industrial and governmental ties while preserving their intellectual freedom. And in most cases, the college

or university is, in fact, uncompromised by such relationships. But the trends for increased collaboration in the future seem clear. So more and more institutions may find it necessary to review their position vis a vis business and industry, if they wish to preserve some measure of academic separation. The issue could be an important one at some institutions in the years ahead.

D. Prospects for the Future

152. There could be tough times ahead for higher education institutions in relation to the NIT. The demand for research results is strong, but the resources to conduct the necessary studies are being cut. The demand for professional training in the field is strong, but it may only be a short-term phenomonen, better addressed by training conducted in the workplace. The demand for education opportunities by adults is strong, but the NIT offer great opportunities for learning directly in the home, separate from any higher education institution. (Evidence is already growing that many more adults watch educational TV programs offered as courses by local colleges than actually sign up with the school to take the course for credit.) The demand for cooperation with business and industry is strong, but contains some inherent dangers. And finally the demand for cooperation on an international scale is strong regarding the development and use of the NIT, but immediate prospects for such large scale cooperation across country boundaries are dim.

153. The actual scenario over the next decade is not likely to be quite so bleak. Institutions of higher education in most if not all Member countries can be expected to play a significant role as the NIT become more widely available, accepted and utilized. Government policies will undoubtedly recognize to a greater extent than at present the importance of higher education's contribution to these developments.

154. The impact on colleges and universities may be considerable changing long-held views of student learning styles, faculty roles and administrative structure. The issues to be addressed are substantial but the prospects are exciting.

NOTES AND REFERENCES

1. Countries responding to this section of the survey include Belgium, Finland, France, Iceland, Ireland, Japan, Scotland, Sweden, Turkey, and the United Kingdom

2. Varley, Donald E. "The Universities in Western Europe: a personal view of certain trends," in European Journal of Education, Vol. 15, No. 1, 1980.

3. Markham, James M. International Times Herald, February 22, 1984, Paris Edition.

4. Varley, op. cit.

5. OECD, 1983, and 1982.

6. Cerych, Ladislav, Computer Education in Six Countries: Policy Problems and Issues. Paris, France: Institute of Education, June 1982.

7. Report to the Minister of Education by Le Corre, Yves and Claude Pair, 15.10.1981, Ministry of Education, Information Service, Paris, France.

8. Education and the New Information Technologies: provisional draft. Paris: EEC, 1983.

9. Shain, Irving, "National Information Policy Issues and Higher Education," in EDUCOM Bulletin, Vol. 17, No. 1, Spring, 1982.

10. For an overview of European national policy developments, see Cerych, Ladislav, op. cit.

11. Department of Education and Science Press Notice 299/82, 16 December 1982, and 302/82, 21 December 1982.

12. Cerych, Ladislav, "Computers in Education: major problems and key policy options," in European Journal of Education, Vol. 17, No. 4,

1982.

13. Lewis, Raymond J., Meeting Learners' Needs Through Telecommunications; A Directory and Guide to Programs. Washington, D.C.: Center for Learning and Telecommunications, 1983.

14. Ibid.

15. Ibid.

16. Most of these institutions are described in CRE-Information, No. 64, 4th Quarter, 1983.

17. For details of Fernuniversitat's operations, see Peters, Otto, "Tradition and Technical Innovation - The Fernuniversitat in Hagen, West Germany," in CRE-Information, op. cit.

18. Northcott, Paul, "Applications of technology to distance education at Deakin University, Australia," Paris: OECD, 1983.

19. van Schalkwijk, Harry, "The Correct Use of New Technology," in CRE-Information, op. cit.

20. vand der Drift, Koen D., "Education and automation: status and opinions," University of Leyden, The Netherlands, n.d.

21. For similar Dutch findings, see also Akkermans, Jaap and Jef Moonen, "Computers in Education: The Netherlands", Workshop Council of Europe, Frascati, November, 1982.

22. O'Shea, Timothy, "Computer Aided Learning in Distant Education," in CESTA, Applications des Nouvelles Technologies a L'Education Multimedia, March 1983.

23. For a detailed study of costs, see Eicher, Jean-Claude, "Economic Aspects of the Introduction of NIT in Education," Paris: OECD, CERI/NT/84/06.

24. Feasley, Charles E., Serving Learners at a Distance; A Guide to Program Practices. Washington, D.C.:ASHE-ERIC Higher Education Research Report, 1983.

25. Goto, Tadahiko, "SIS-TEM III-A Computer-Based Educational System," in Educational Technology Research, Vol. 4, Nos. 1,2, November 1980.

26. van Schalkwijk, op. cit.

27. For more information on the software issue, see Le Corre, Yves and Jack Schwartz, "Software and Courseware," Paris: OECD, CERI/NT/84.05.

28. Forsythe, K. and V. Collins, British Columbia - Higher Education and the Integration of a New Technology. Victoria: November, 1983.

29. ERIC/CAPS, "Counseling In A Hi-Tech Age," in CAPS Capsule, No. 3, 1983. See also Christoffel, Pamela, "New Technology and Adult Learning in America: Can Barriers Be Lowered?" Washington, D.C., 1983.

30. ERIC/CAPS, "Counselors and Computers," in HIGHLIGHTS, An ERIC/CAPS Fact Sheet, 1983.

31. See "Electronic Text and Higher Education: Lessons from the United Kingdom," in TELESCAN, Vol. 3, No. 1, September/October, 1983.

32. McCredie, John and William Timlake, "Evolving Computer Networks in American Higher Education," in TELESCAN, Vol. 3., No. 3, January/February 1984.

33. In The European Journal of Education, op. cit.

34. Gorny, Peter, "New Information Technologies in Education in the Federal Republic of Germany," in the European Journal of Education, ibid.

35. Feasley, op. cit.

36. Lewis, op. cit.

37. Op. cit.

38. Ibid.

39. Forsythe and Collins, op. cit.

40. Op. cit.

41. Ibid.

42. "New Forms of Co-Operation and Communication Between Industry and the Universities," Paris: OECD DSTI/SPR/83.82.

43. van der Drift, op. cit.

44. In Education and the New Information Technologies, op. cit.

45. Similar questions in a broader context are raised by Ceryich, "Computers in Education," op. cit.

46. Christoffel, op. cit.

47. See Eicher, op. cit.

48. Arbeiter, Solomon, "Guns, Butter or Sheepskins? The Military, Business and College Competition for High School Graduates in the 1980's," in The College Board Review, forthcoming. See also the work of Rumsberger, R.W. in The Job Market for College Graduates, 1960-1990. Palo Alto: Stanford University, 1983.